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DRAWINGS ATTACHED

1 320 868

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(19)

(54) SYNTHETIC GRASS

(71) We, POLIGRAS GESELLSCHAFT FUR SPORT-UND RASENTEPPICHE MIT BESCHRANKTER HAFTUNG, a German Company, of 7, Stuttgart-1, Kleiner Schlossplatz 11, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to synthetic grass.

As is known, the use of natural grass as a playing surface for various types of sport involves many difficulties in respect of varying climatic conditions; excessive dryness may destroy the surface of the grass or maintenance thereof is made expensive and difficult, or excessive rainfall may soften the nap of the grass and make it unplayable or cause its surface to be destroyed as soon as it is played on. Moreover, natural grass can only be played on for at most two days a week if it is to be maintained in a satisfactory condition, and even in respect of grass which is not played on very often, and given relatively favourable climatic conditions, it is not possible for the playing surface to avoid showing even more pronounced unevenness in the course of the year so that it must eventually be replaced completely. In order to attempt to overcome the problems outlined above, various synthetic grasses have been developed on which it should be possible to play on the grass irrespective of the weather at all times of the year, and to use the synthetic grass surface continually and not only on two, or at most three days a week.

However, known synthetic grasses (e.g. as described in U.S. Patent Specification 3,332,828, German Offenlegungschrift 1,933,048 or German Gebrauchmuster 6,914,975) suffer from the disadvantage that it is impossible to play on them during and after rainfall, as the rain can only be drained off slowly and incompletely. This disadvantage is caused by the fact that the fibres which form the pile of the grass are either held by a very thick base tissue or by a reverse holohedral coating of the base tissue with a plastics material such as polyvinylchloride or a rubbery mass, resulting in low water-permeability or even complete water-tightness of the tissue.

It has also been suggested (e.g. as described in German Offenlegungschrift 1,534,383) to make synthetic grasses of the type described above water-permeable in advance by means of the arrangement of the base tissue and the use of suitable material, or to perforate the base tissue which is otherwise impermeable to water during or after the drying process with needles of suitable thickness. However, it is necessary to ensure the pile threads remain firmly held if the material is perforated or if a more porous type of tissue is employed; on the other hand the water permeability of the base tissue will not permit the desired drainage unless a markedly water-permeable layer was provided underneath the base tissue since the water could only penetrate into the tissue holes but not further because known base tissues are practically even on their undersides and thereby prevent water which had passed through the holes in the base tissue from draining off. It has thus been found necessary to provide the grass with a foundation which was similarly water-permeable and which collected and drained away the water.

The invention consists in synthetic grass comprising a water-permeable textile base support and a pile secured through the threads of the textile base support, and a

coating on the back of the grass binding the pile to the textile base support, wherein substantially only elevated structures formed on the back of the grass by means of the connection between the pile and the textile base support are coated thus providing an apertured basal coating which is permeable to water.

The textile base support fitted with the pile is water-permeable to a large extent while the pile fibres remain securely held in the tissue. Since the underside of the textile base support is only partially coated, the apertures formed in the base support remain open to permit the passage of water. In addition, the underside coating ensures that the textile base support can be relatively porous while firmly holding the pile. Furthermore, the underside of the grass forms drainage channels even when it is laid on an even foundation, so that the water which is passing through the grass can drain off. It is therefore preferable to provide a textile base support having a structure with distinct apertures which are substantially not covered by the coating.

Preferably the textile base support has two thread systems which bond the pile, one thread system being formed from a thinner thread than the other thread system and the pile so as to form the apertures in the base. Thus the base support has on its underside a distinct structure of generally parallel ribs forming distinct drainage channels. Advantageously these ribs are coated on the back of the base support.

During the manufacture of the synthetic grass the back of the textile base support may be coated with a binding agent, and the textile base support subsequently stretched laterally towards the longitudinal axis of its ribs at least during the setting of the binding agent; this may be achieved by means of a tenter.

The textile base support is stretched after the binding agent has been applied, which is usually carried out after the beginning of hardening or gelling. The binding agent which is then no longer able to flow is destroyed between the ribs to form the required apertures.

The structures referred to above can be produced easily and economically on a Raschel knitting machine and have proved to display the above advantages since it is possible during manufacture on two-bed flat knitting frames to simultaneously produce two strips of grass which are then connected to each other by means of a joint pile, which is subsequently perforated. In such a base support made from Raschel products with a firm fringe the pile is so bound that it further increases the rib structure on the underside of the base support, and is firmly held despite the only partial coating on the back of the base support, as it is precisely these ribs which are coated on the underside. Thus the grass is more pervious to water and more easily drained.

The pile of the grass are suitably made from polypropylene and nylon, while the base support is preferably a polyester. Polyvinylchloride-dispersions is suitable for coating the base support.

Although the grass is provided with channels for draining away the water which has passed through the pile, it is preferable to provide a water-permeable elastic drainage layer underneath the base support. This not only improves the drainage of the water but also enhances the tread properties of the grass; if the base support lies directly on the drainage layer, then advantageously the layer has rubber granules and plastics and/or bitumen in the region adjacent the base support. In a particular preferred arrangement an underlayer made from water-permeable elastic material is provided directly underneath the base support. The elastic material may have a cellular structure to increase the volume which can be quickly filled with water; the tread property of the grass is also increased. An underlayer of this kind can also serve to prevent the base support from slipping on a flat foundation. The underlayer thus assists the holding of the actual grass. An underlayer made from a high-tensile cellular structure, preferably a foam anti-slip mat of the type laid under carpets, is suitable if the cellular structure has an elastic coating which does not absorb water, and which forms a drop-shaped structure on the underside. Consequently water which has passed through can also drain away under this underlayer. Softer polyvinylchloride is suitable as the underlayer coating.

If an underlayer of this type is placed underneath the base support the drainage layer is preferably of gravel, bitumen, rubber granulate and, if necessary, hardenable plastics and hardeners, the fineness of the gravel increasing towards the underlayer. Even without a cellular underlayer as described above the drainage layer can be gravel, bitumen, rubber granulate and age-hardening plastics. The composition of the drainage layer can be such that the drainage layer contains more rubber granulate and finer gravel in its upper region than in its lower region. A drainage layer formed in this manner is water-permeable and possesses a certain tread elasticity which in conjunction with that of the actual grass and the underlayer simulates a state similar to that of natural grass.

It is known to heat synthetic grass with heating elements. However in the case of known constructions (cf. as described in German Offenlegungschrift 1,534,384) these

are provided in an air space which adversely affects on their efficiency. Heating elements may be provided in the drainage layer, preferably in its upper or middle zone. There may be provided in the drainage layer attachment rails for the grass, i.e. for the textile base support and if necessary the underlayer; these attachment rails are preferably section rails open at the top. If sharp downward-pointing claws are provided on the insides of the section rails the laying and fixing of the grass can be easily carried out.

The invention will be further described, by way of example only, with reference to the accompanying drawings, in which:—

Figure 1 is a vertical section through synthetic grass arranged over a foundation;

Figure 2 is an enlarged view of the part A indicated in Figure 1;

Figure 3 is a perspective view of an attachment rail;

Figure 4 is a view similar to that shown in Figure 2, but showing a different form of attachment rail; and

Figures 5 and 6 are perspective views of a piece of synthetic grass, taken from above and below respectively;

Figures 7 and 8 are detailed views showing the construction of the base support and the pile of synthetic grass;

Figure 9 is a perspective view of an underlayer for the grass; and

Figure 10 is a view similar to that shown in Figure 6, and shows the manufacture of the coating of the back of the piece of grass.

Figure 1 shows synthetic grass arranged over a foundation, the foundation lying on earth 2 which has been suitably levelled and made firm if necessary. Tapered concrete ribs 4 lie parallel to each other on the earth with their narrower portions uppermost. Between the concrete ribs 4 is arranged gravel ballast 6, the upper surface of which is substantially flush with the uppermost portions of the concrete ribs 4, and on which is laid drainage layers 8, 10.

Attachment rails 12 are attached to the tops of the concrete ribs 4. On the top of the drainage layer lies an underlayer 14 and on the latter there lies synthetic grass comprising a textile base support 16 and a pile 18 held therein. The base support 16 and pile 18 together with the underlayer 14 are held in the attachment rails 12.

Irrespective of the weather, synthetic grass as shown in Figure 1, for example provided on football pitches, should ensure that there will always be a playable area and furthermore that playing on the area will not be subjected to very strict limits in respect of the number of times the pitch can be played on but will allow virtually unlimited use. Although in the drawing there is provided gravel ballast 6 which can then be drained of water, for example by means of circular drainage (not represented in the drawing), it will suffice in the case of porous and absorbent soil to sink the concrete ribs 4 into the soil and fix the drainage layers 8, 10 directly on top of the soil.

As shown in Figure 2, the attachment rail 12 has the shape of a section rail open at the top and is fitted on its upper surface with claws 20 which extend diagonally downwards and which, as can be seen from Figure 3, are formed from punched parts of the rail wall. The claws can thus be produced in a particularly simple manner; the punched form of the claws 20 further ensures that water penetrating into the section from above can leave again laterally.

The base support 16 fitted with the pile 18 and the underlayer 14 hang into the claws so that the grass is connected to the subsoil in a slightly stretched condition. In order to secure the grass a securing member 22 is fitted into the space which remains after the grass and the underlayer have been at least partly hung in the section rail, and prevents the claws 20 from being bent upwards when the grass is subjected to pressure. Preferably, the securing elements are coloured and serve, particularly at the edge of the field of play, to simultaneously mark the pitch. In order to avoid damage to the underlayer 14, the sharp upper edges of the attachment rails 12 are fitted with corner protections 24, for example an elastic plastics material.

Figure 4 shows a different form of attachment rail from the attachment rail 12 shown in Figures 2 and 3. The attachment rail is similarly a section rail open at the top but has stepped side walls forming a widened lower part. As before, on underlayer 14 and grass 16, 18 are hung in claws 20; clamping rails 26 are then inserted into the attachment rails. The clamping rails are pressed outwards by means of a suitable securing element 22 against the side walls of the lower widened part of the attachment rail. By this means the grass 16, 18 and underlayer 14 are clamped between the side walls of the attachment rails 12 and the clamping rails 26. The firmness of the support is further aided by the fact that in addition to the clamping effect and the hanging in the claws 20 the successive turning of the grass by 90° prevents the grass from being pulled out of the attachment rail.

Steel supports may be used instead of concrete ribs as supports for the attachment rails; in addition, it is possible to combine the attachment rails by means of suitable anchors to the subsoil. Further ribs lying transverse to the ribs 4 may be advantageously provided, in particular for fairly large playing areas; these further ribs may also support attachment rails so that the playing

field is divided up into individually braced grass zones.

Figure 7 shows in perspective representation a greatly enlarged view of an area of grass obtained from a two bed flat knitting machine. In such a machine two plies of grass are produced at once, the textile base supports in Figure 7 being designated 16 and 16¹, the pile 18 linking the two plies together being common to both these supports. The threads forming the pile should be strong plastics strips and are made conspicuous by pointing. Woof and/or fringe 28 and 28¹ should be considerably stronger than chain 30 and 30¹ of the base supports 16 and 16¹ in order to produce together with the pile, which is equally strong, the rib structure shown in Figure 6 on the underside of base supports 16. After knitting the pile 18 is cut through between the base supports 16 and 16¹ to produce two separate plies of grass. Such a ply is seen in plan view from underneath in Figure 8 in which for the sake of simplicity the pile has been omitted; a loop 18 makes it easy, as in Figures 5 and 6, to recognise the strip shape of the pile. Figure 8 also demonstrates that by means of the use of a strong fringe 28 and a strong pile 18 in conjunction with a weaker chain 30, there may be obtained comparatively large apertures 32 in the base support 16 as well as distinct small portions 33 on the latter's underside. A Raschel fabric used as the base support for the synthetic grass has a distinct surface structure when formed from suitable thread strengths. The reverse coating of the base support 16 of the synthetic grass which is produced in this manner is then applied in such a way that essentially only the portions 33 and where appropriate the woof or the fringe 28 are coated on the back to form a latticed base support with uncoated apertures 32. The coated portions 33 form continuous ribs 34, as shown in Figure 6.

Because of the distinct surface structure of the textile base support, the coating can be applied to the bound pile by means of a simple roller; if apertures 32 are still blocked, for example as a result of the tendency of the freshly deposited coating to flow, it is expedient to stretch the textile base support laterally towards the ribs 34, particularly if the coating starts to solidify when entering a heat zone. A tentering frame 35 can be used to stretch the base support in this manner, as is shown in Figure 10; the direction of stretch is indicated by arrows A.

Between the ribs 34 there are channels whose cross-section is reduced in places by the woof 28 without adversely affecting the drainage through the channels. Water which passes from the surface of the pile can flow practically unhindered through the uncoated apertures 32 of the base support. This ensures that the water not only reaches the underside of the base support but can also be then easily drained off through the channels, even if the base support lies on a water-tight layer as long as the latter has an adequate inclination.

Figure 9 is a perspective view from above of the underlayer for the synthetic grass. The underlayer 14 consists of a core 36 made of foam anti-skid matting and having apertures 38 therein. In order to produce the underlayer 14 the perforated foam mat is dipped in a soft PVC-mass whose viscosity is such that the foam mat is initially completely covered with soft PVC. After the removal of the mat from the soft PVC mass, excess material gathers on the lower surface of the foam mat and there solidifies into drop-shaped protrusions 40; the upper part of the foam mat, in particular the upper surface is covered with a uniform relatively thin PVC layer 42 and thus made impervious to water. The protrusions 40 make the underlayer particularly suitable for use in connection with the synthetic grass described above. The water which penetrates the grass and passes through the channels between the ribs 34 can then pass through the apertures 38 in the underlayer 14 into the space between the lower surface, the underlayer and the upper side of the drainage layer 8, 10. Since the underlayer 14 rests on the drainage layer on the protrusions 40, the space between the underlayer and the drainage layer is sufficiently large to ensure rapid absorption and draining of even fairly large amounts of water which occur, especially if allowance is made for sloping of the subsoil. Because of its shape the underlayer 14 also increases the elasticity of the grass despite the fact that it only partially consists of foam and otherwise of unfoamed material. It further ensures, because of its water-tight covering, that no water is retained on the underside of the grass, which is particularly significant if there is the danger of frost and thus the possibility of the formation of ice. The fact that the formation of ice underneath the playing surface is prevented is very valuable in respect of a climate such as in Germany for example. In such a climate at certain times of the year the temperature often varies several times a day either side of zero. If, during a period of thaw, the subsoil absorbs water until it is full then in the event of a following period of frost the water solidifies under the playing surface, adversely affecting the elasticity of the surface. In addition, playing on synthetic grass with a frozen subsoil may damage the material or cause severe injuries to the players. Use of the underlayer 14 ensures that no water can penetrate the coated foam mat so

that the latter retains its elasticity and will not be destroyed as may be the case with soaked foams which can break up when frozen.

Preferably the drainage layer lying underneath the underlayer 14 consists of an upper zone 8 and a lower zone 10, the two zones differing essentially in respect of the fineness and proportions of their constituents. As mentioned above, the upper zone of the drainage layer consists of relatively fine gravel, bitumen, relatively large amounts of rubber granulate, hardenable plastics and hardeners. This zone thus not only possesses considerable elasticity which is necessary in order to simulate the state of natural grass, but is also water-permeable because between gravel and rubber granulates there are cavities through which the water can drain off. The material for such a layer is comparatively cheap, the rubber granulate being obtained from regenerated old car tyres. Preferably the drainage layer includes square rubber granulate and polyurethane. Such a layer may be advantageously employed if the protrusions 40 of the underlayer 14 are glued to the drainage layer 8, 10. Heating elements 44 (see Figure 4) for dispersing the water more quickly can suitably be provided in a drainage layer as described above. In particular, heating elements in the form of cables are suitable when inserted approximately in the middle of the drainage layer in rough rolled grooves which may be produced by means of a patterned mat which impresses a latticed profile. In this manner, practically all the heat produced by the elements can pass directly to the playing surface without involving the heating of air.

The lower zone 10 of the drainage layer is formed in the same way as the upper zone 8 but, in order to increase its rigidity, contains coarser gravel and less rubber granulate. For permeable soils it can lie directly on the subsoil, or for non water-permeable soils it can lie on gravel ballast which is suitably drained. The quality of the synthetic grass is only dependent to a very limited extent on the type of attachment; in respect of the attachment means it is necessary to ensure draining of the water which is passing through from above. If this is not the case then both the actual grass and also the underlayer may be destroyed by formation of ice in the supports and thus the grass may no longer be firmly held.

WHAT WE CLAIM IS:—

1. Synthetic grass comprising a water-permeable textile base support and a pile secured through the threads of the textile base support, and a coating on the back of the grass binding the pile to the textile base support, wherein substantially only elevated structures formed on the back of the grass by means of the connection between the pile and the textile base support are coated thus providing an apertured basal coating which is permeable to water.

2. Synthetic grass as claimed in Claim 1 wherein the textile base support has distinct apertures substantially free from the said coating.

3. Synthetic grass as claimed in Claim 2 wherein the textile base support is composed of two thread systems knitted together to bind the pile, one thread system being formed from a substantially thinner thread than the other thread system and the pile to form the said apertures.

4. Synthetic grass as claimed in any of Claims 1 to 3 being a Raschel fabric manufactured on a Raschel knitting machine.

5. Synthetic grass as claimed in Claim 4 wherein the chain of the Raschel fabric consists of a thinner thread than the woof and pile.

6. Synthetic grass as claimed in any of Claims 1 to 5 wherein the generally parallel ribs are formed on the underside of the said textile base support by the connection between the latter and the pile.

7. Synthetic grass as claimed in any of Claims 1 to 6 wherein the said coating consists of soft polyvinylchloride.

8. Synthetic grass as claimed in any of Claims 1 to 7 wherein a water-permeable underlayer made of elastic material is provided directly underneath the said textile base support.

9. Synthetic grass as claimed in Claim 8 wherein the said underlayer has apertures formed therethrough to permit the passage of water and is provided on the side remote from the textile base support with downwardly projecting parts arranged to form drainage channels when the said underlayer rests on a plane surface.

10. Synthetic grass as claimed in Claim 9 wherein the underlayer is made from a high tensile cellular structure with an elastic non-water-absorbing coating.

11. Synthetic grass as claimed in Claim 10 wherein the said non-water-absorbing coating consists of soft polyvinylchloride.

12. Synthetic grass according to Claim 1 substantially as herein described with reference to, and as shown in, the accompanying drawings.

13. A method of producing a synthetic grass as claimed in Claim 6 comprising coating the back of the textile base support with a binding agent, and subsequently stretching the textile base support laterally to the longitudinal axis of the said ribs, at least during the setting of the binding agent.

14. A method as claimed in Claim 13

substantially as herein described with reference to, and as shown in, the accompanying drawings.

MARKS & CLERK,
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Agents for the Applicants.

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Fig. 1

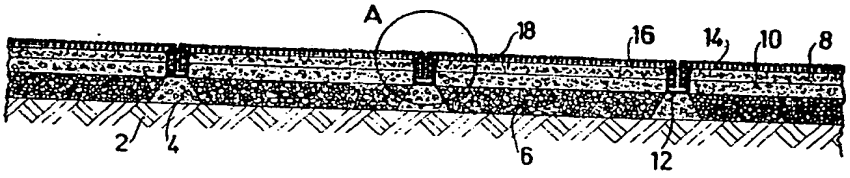
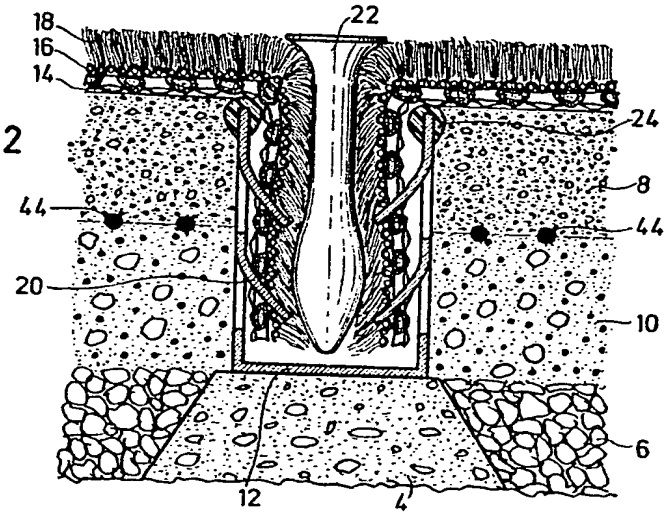


Fig. 2



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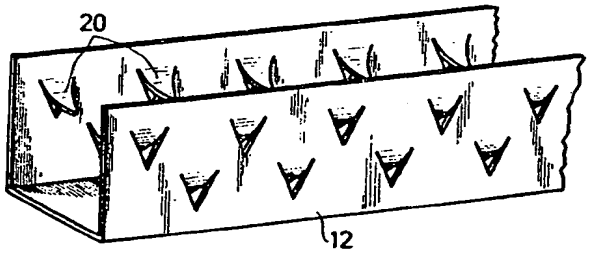


Fig. 4

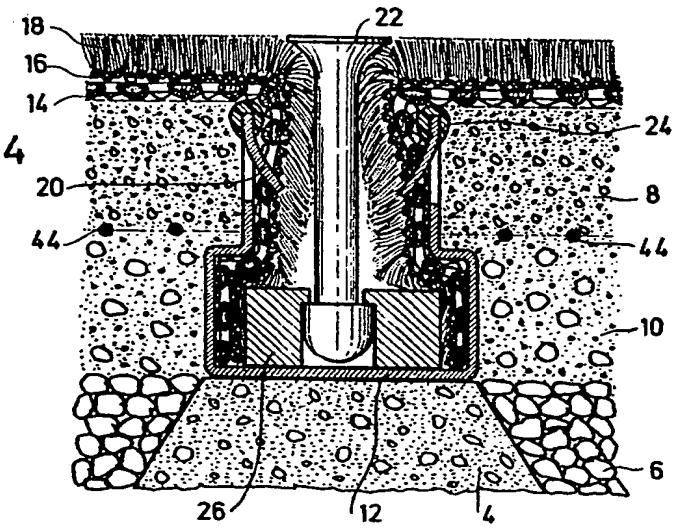


Fig. 5

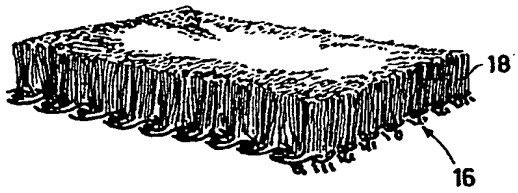
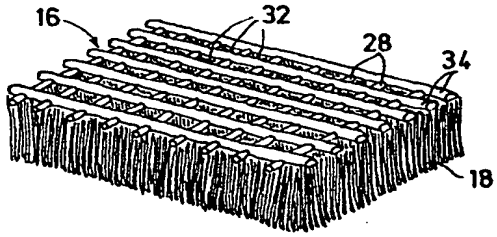


Fig. 6



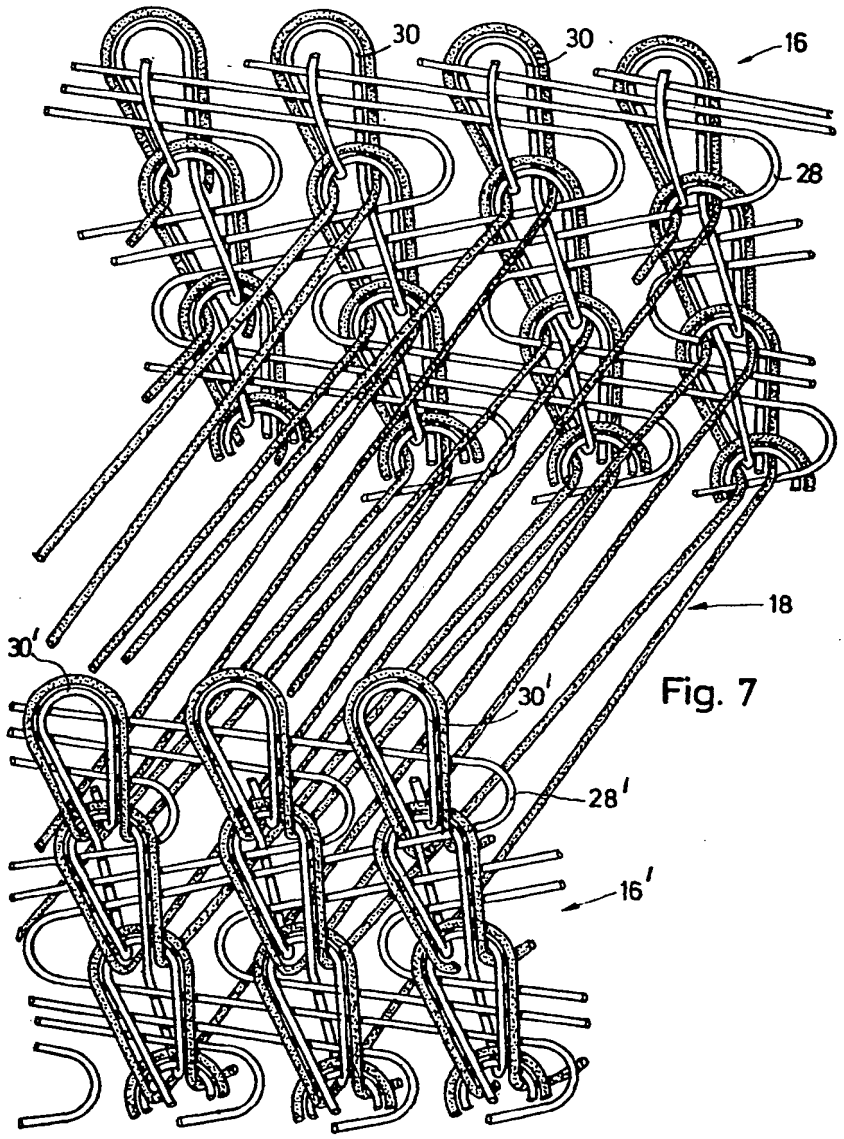


Fig. 7

Fig. 8

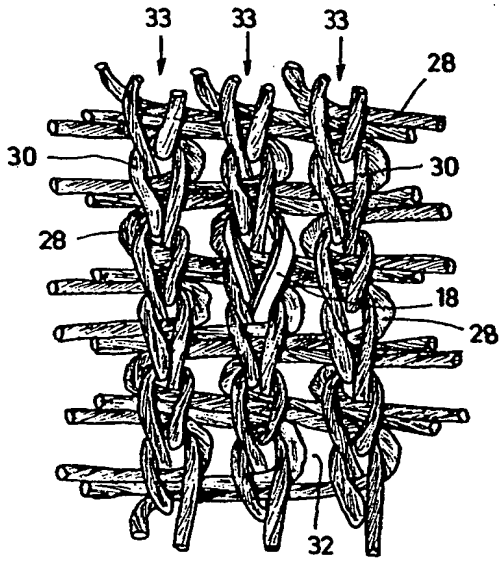


Fig. 9

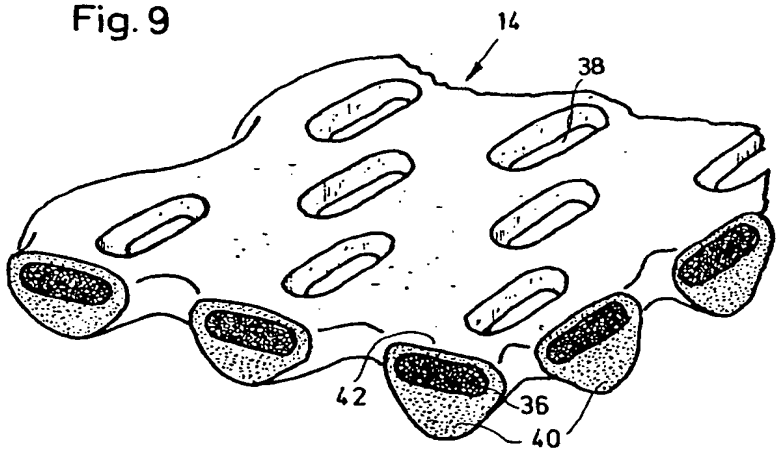


Fig. 10

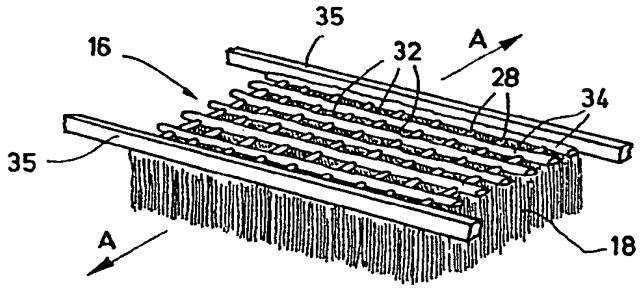


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Fig. 1

Fig. 2

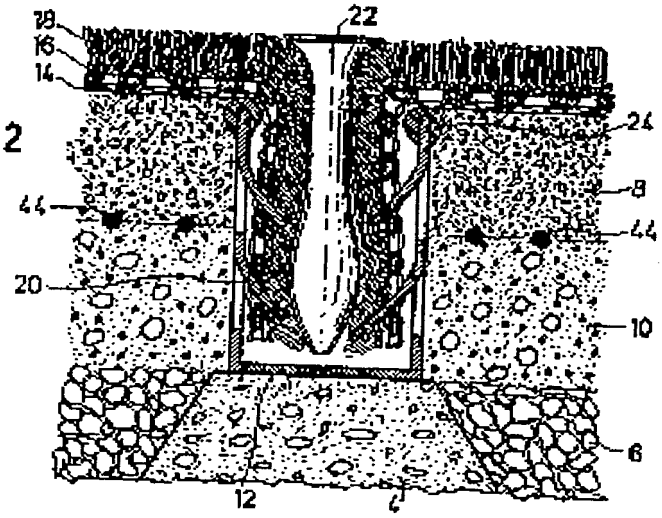
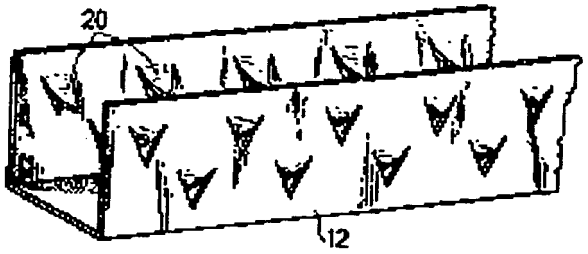


Fig. 3



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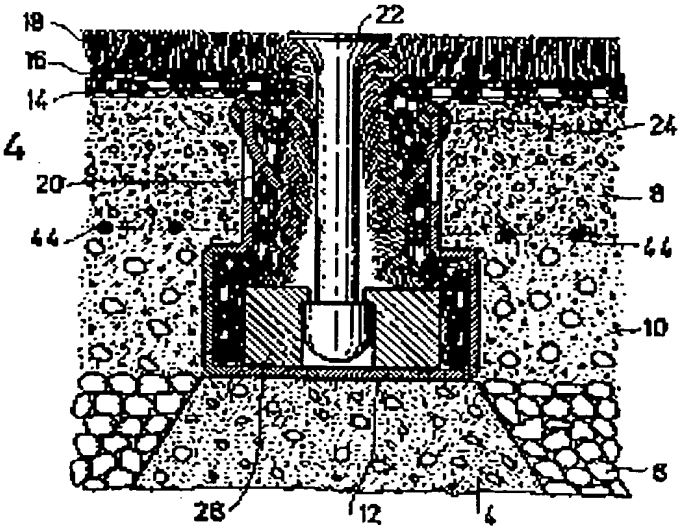
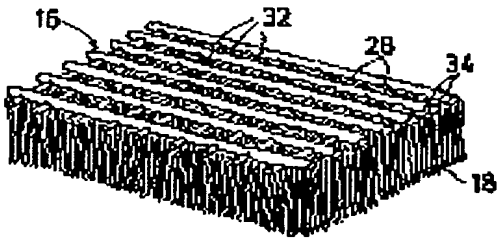


Fig. 5

Fig. 6



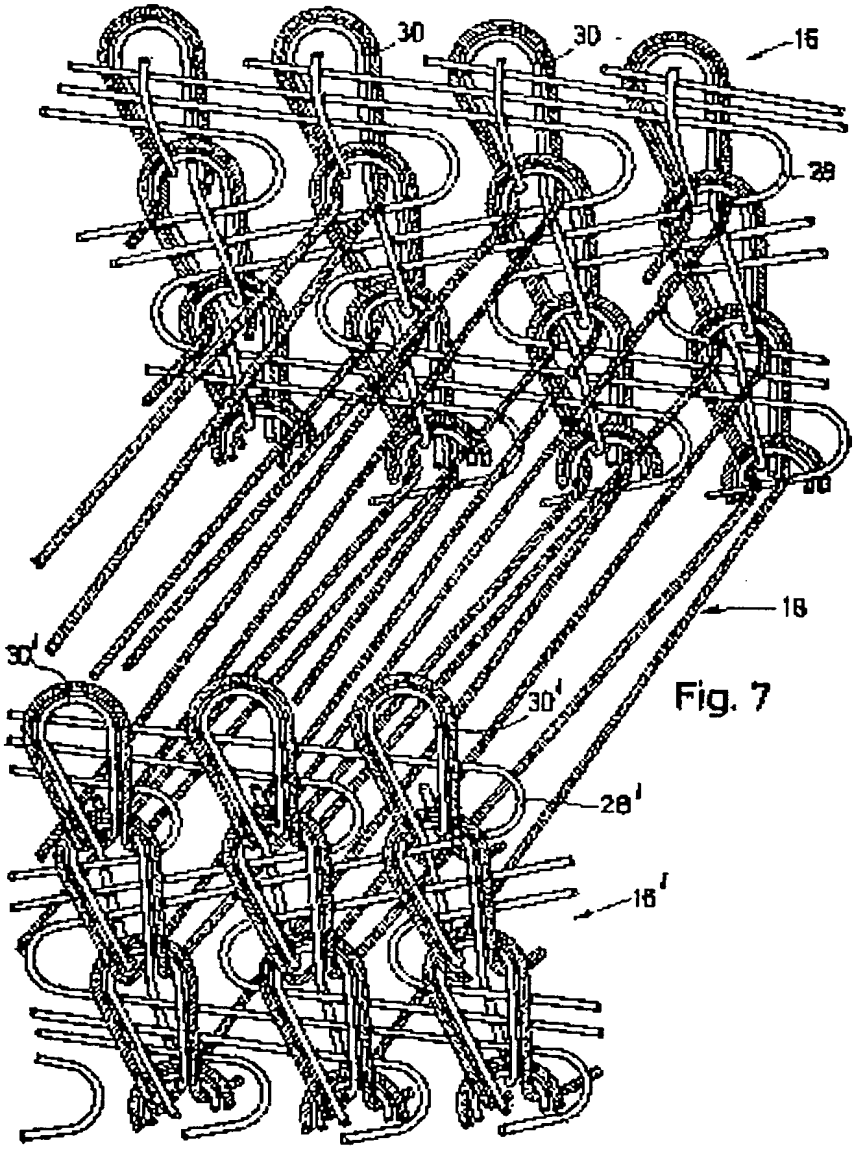


Fig. 7

Fig. 8

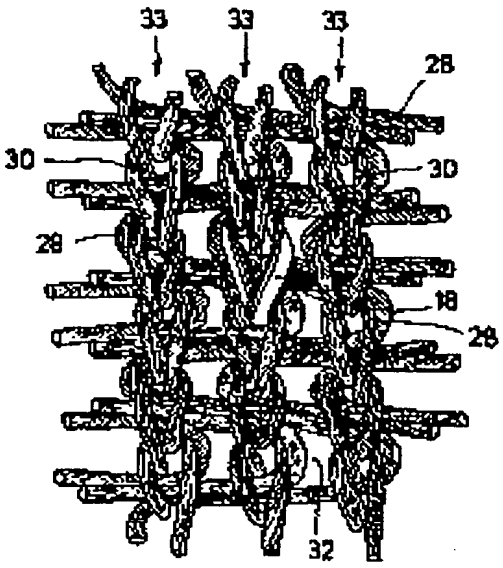


Fig. 9

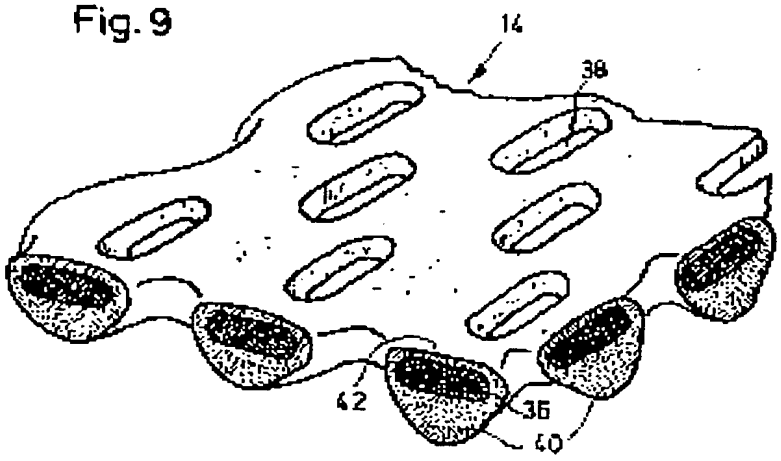


Fig. 10